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## Constraining New Physics with High Multiplicity : Ultra-High Energy Cosmic Rays on air-shower detector arrays

Having no new physics signals observed at collider experiments, we are motivated to consider a scenario that the new physics scale is higher than the current collider energies but still within the reach of the cosmic ray experiments covering beyond TeV scale. In particular, we focus on the types of new physics interactions accompanying with high multiplicities in their signals from the collision of Ultra-High Energy (UHE) cosmic ray with nucleons in the Earth atmosphere with collision energy E > O(100) PeV or Ecm > O(10) TeV in center-of-mass (CM) frame. The characteristic features of neutrino-induced air- showers and proton-induced air-showers induced by new physics interactions are identified then the experimental constraints on the new physics scale are obtained from the existing and future coming data from Telescope-Array (TA) and Pierre-Auger experiments. As specific examples we show the results from electroweak sphaleron and TeV scale microscopic black holes in detail.

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